The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(1): 648-650, 2025 www.thebioscan.com

Evaluation of Organic and Inorganic Amendments on Soil Physicochemical Properties in Soybean (*Glycine max L.*) Cultivation

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DOI: https://doi.org/10.63001/tbs.2025.v20.i01.pp648-650

KEYWORDS
Integrated fertilizer, Bulk density, Organic content, soil pH, electrical conductivity, Soybean
Received on:

18-01-2025

Accepted on:

15-02-2025

Published on:

20-03-2025

ABSTRACT

Soil health is a fundamental determinant of crop productivity. Deterioration of its physical properties led to depletion of soil fertility which are the main constrains in food and environment security (Titirmare *et al*., 2023). Experimental Design used for the study was CRBD (Complete Randomize Block Design) with three replications of each treatment. Ten different treatments involved in the study were T1 Control (Recommended dose of fertilizers) T2 (50% NPK + Vermicompost), T3(50% NPK + Farm yard manure, T4 (50% NPK + *Rhizobium japonicum*), T5 (50% NPK + PSB (phosphate solubilizing bacteria), T6(50% NPK + Mycorrhiza, T7(50% NPK + 25% Vermicompost +25% Farm yard manure), T8(50% NPK + 25% *Rhizobium japonicum* + 25% PSB + 25% Mycorrhiza), T9(50% NPK + 25% Vermicompost +25% Farm yard manure + 25% *Rhizobium japonicum*), T10(20% Chicken manure +20% Farm yard manure + 20% *Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza). The result indicate that the lowest bulk density (1.27 mg/m^3) was observed in the T2 (50% NPK+ Vermicompost). Organic content was highest (0.38%) in treatment T2 (50% NPK+ Vermicompost and T7 (50% NPK + 25% Vermicompost +25% Farm yard manure).

Result indicate that the lowest bulk density (1.27 mg/m^3) was observe in T2 (50% NPK+ Vermicompost) treatment. Organic content was highest (0.38%) in treatments with T2 (50% NPK+ Vermicompost) and T7 (50% NPK+ 25% Vermicompost + 25% FYM). Lowest soil pH (7.22pH) was observed in 50% NPK+ Vermicompost and T7 (50% NPK+ 25% Vermicompost + 25% FYM). Electrical conductivity significantly decreased after soybean harvest across all the treatment, which was recorded lowest in T10 (20% Chicken manure +20% Farm yard manure + 20% *Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza). The study showed that, using organic and inorganic in integrated form is an alternative system for the sustainable and cost-effective management of soil health without affecting environment.

INTRODUCTION

Soybean (*Glycine max* L. Merrill) is one of the important oilseed crop of India. From nutritional point of view, it is called as miracle bean. Soybean cultivation improves soil health because of its atmospheric nitrogen fixing ability and deep root system. The soil organic matter is the storehouse of all the energy material required by most of the soil microorganisms. The soil physical properties are so much dependent on organic matter that the content of the latter in soil can very well serve as an index of the soil condition. The biological activity of an agricultural soil is in a state of dynamic equilibrium which can be altered by changes in temperature, water content, or by the addition of more usable organic material (Smith *et al.*, 2017). Regular additions of organic materials help in maintaining the tilth and productivity of the soil and reduce soil erosion, run off and leaching.

Use of organic manure through incorporation or as a mulch improves the physical, chemical and microbiological conditions of the soil. In addition to this, it also improves the water holding capacity; increases soil porosity, germination percentage, and checks weed infestation and ultimately results in higher crop yields. Application of organics improves physical, chemical and biological properties of the soil and maintain favourable environment for the growth of the crop. However, several decades ago organic recycling practices in some countries were largely replaced with chemical fertilizers that were applied to high yielding cereal grains that responded best to high level of fertility, but intense use of chemical fertilizers alone poses serious threat to sustainability of agriculture production (Lal, 2015).

Soil health and fertility are crucial for sustainable soybean production. The integration of organic and inorganic amendments can influence soil physicochemical properties, affecting plant growth and yield. Several studies have highlighted the importance of maintaining soil organic matter and microbial activity for improved soil fertility and structure Organic amendments such as compost and manure not only provide essential nutrients but also enhance soil microbial communities, leading to improved nutrient cycling and plant health (Bhaduri & Saha, 2019). This study investigates the impact of different nutrient management

strategies on soil bulk density, organic content, pH, and EC in a soybean field.

Materials and Methods

The experiment will be conducted in Crop Research Centre block during kharif season year 2019-20 and 2020-2021, in Department of Agronomy, S. G. R. R. University, Dehradun. Experimental Design used for the study was CRBD (Complete Randomize Block Design) with three replications of each treatment. The study was conducted on soybean field and involved Ten different Treatments combination: T1 Control (Recommended dose of fertilizers) T2 (50% NPK + Vermicompost), T3(50% NPK + Farm yard manure, T4 (50% NPK + *Rhizobium japonicum*), T5 (50% NPK + PSB (phosphate solubilizing bacteria), T6(50% NPK + Mycorrhiza, T7(50% NPK + 25% Vermicompost +25% Farm yard manure), T8(50% NPK + 25% *Rhizobium japonicum* + 25% PSB + 25% Mycorrhiza), T9(50% NPK + 25% Vermicompost +25% Farm yard manure + 25% *Rhizobium japonicum*), T10(20% Chicken manure +20% Farm yard manure + 20% *Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza). The result indicate that the lowest bulk density (1.27 mg/m^3) was observed in the T2 (50% NPK+ Vermicompost). Organic content was highest (0.38%) in treatment T2 (50% NPK+ Vermicompost and T7 (50% NPK + 25% Vermicompost +25% Farm yard manure). Soil samples were collected before planting and after harvest to measure: Bulk density (mg/m^3), Organic content (%), Soil pH and Electrical conductivity (EC, dS/m).

Result and Discussion

Table1: Showing the Change in Bulk density, Organic content, Soil pH and Electrical Conductivity of soil of soybean field after harvest under different treatments.

Treatments	Bulk Density (mg/m3)		Organic Content (g/kg)		Soil pH		Electrical Conductivity (dSm^{-1})	
	Initial	Harvest	Initial	Harvest	Initial	Harvest	Initial	Harvest
T1: Control (Recommended dose of fertilizers)	1.35	1.34	0.3	0.33	7.36	7.29	0.258	0.24
T2: 50% NPK + Vermicompost	1.34	1.27	0.32	0.38	7.35	7.22	0.257	0.24
T3: 50% NPK + Farm yard manure	1.35	1.29	0.33	0.37	7.36	7.23	0.257	0.239
T4: 50% NPK + *Rhizobium japonicum*	1.35	1.33	0.32	0.37	7.36	7.24	0.258	0.237
T5: 50% NPK + PSB (phosphate solubilising bacteria)	1.33	1.34	0.31	0.36	7.34	7.26	0.257	0.233
T6: 50% NPK + *Mycorrhiza*	1.34	1.32	0.32	0.36	7.35	7.25	0.258	0.234
T7: 50% NPK + 25% Vermicompost +25% Farm yard manure	1.33	1.28	0.32	0.38	7.34	7.22	0.257	0.239
T8: 50% NPK + 25% *Rhizobium japonicum* + 25% PSB + 25% *Mycorrhiza*	1.33	1.31	0.32	0.34	7.34	7.27	0.258	0.228
T9: 5% NPK + 25% Vermicompost +25% Farm yard manure + 25% *Rhizobium japonicum*	1.34	1.33	0.32	0.35	7.35	7.27	0.255	0.226
T10: 20% Chicken manure +20% Farm yard manure + 20% *Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza	1.35	1.34	0.31	0.34	7.36	7.28	0.254	0.22

Bulk Density

The Bulk density was significantly reduced after harvest of soybean across the treatment. The lowest post- harvest bulk density 91.27mg/m^3) was recorded in T2 (50% NPK + Vermicompost) and the highest was Bulk density was found in the control and T 10 (20% Chicken manure + 20% Farm yard manure + 20%*Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza).

Vermicompost is rich in organic matter and organic colloids, which can promote the formation of good soil structure in soil, increase soil porosity and thus decrease soil bulk density (Zuo *et al*., 2019). Vermicompost also promotes growth of various microbial flora and fauna in soil, which also improves soil structure and decrease soil bulk density. A decrease in the soil bulk density will reduce soil capillary tension and thus the upward movement of water and salt through capillaries, thereby inhibiting soil resalinization (Mao *et al*., 2016).

Organic Content

The organic content of the soil after the harvest was increased with the amendment of 50% NPK + Vermicompost (T2) i.e. (0.38 g/kg), while the lowest organic content (0.3 g/kg) was recorded in the control (RNPK) treatment. Soil by increasing the beneficial microbial flora and fauna in the soil, which play a major role in decomposition of organic matter, which results in increase of organic matter (Olle, 2016). Similar results were reported by Devi *et al*. (2013) and Zerihun, A. and Haile (2017).

Soil pH

It was observed that the treatment T2 (50% NPK + Vermicompost) & T7 (50% NPK + 25% Vermicompost +25% Farm yard manure) both recorded the minimum Soil pH i.e., 7.22 pH over all other treatments during both the years of study as well as pooled analysis. Where-as effect of treatment T3 (50% NPK + Farm yard manure) was found 2nd best with 7.23 pH. The release of organic acids during the microbial decomposition process, which results in a reduction in soil pH. Similar results were observed by Khang *et al*. (2011), Sheikh and Dwivedi (2017) and Gangwar *et al*. (2023).

Electrical Conductivity (EC)

EC values showed slight decrease after harvest in all treatments. The lowest EC (0.22 ds/m) was observed in the treatment with

20% Chicken manure+ 20% FYM + 20% *Rhizobium japonicum* + 20% PSB + 20% Mycorrhiza. The highest post-harvest EC (0.24 ds/m) was observed in the control and 50% NPK + Vermicompost treatments. Similar results were reported by David *et al*. (2022) and Pande *et al*. (2023).

CONCLUSION

The combination of organic amendments with NPK fertilizer enhance soybean production by improving soil properties and health. Use of vermicompost and Farmyard manure (FYM) resulted significant benefits in decreasing bulk density and increasing organic matter content. This study highlights that soil pH and EC remain relatively stable with the organic amendments. Future research should explore long- term results and yield responses to optimize nutrient management strategies.

REFERENCES

- Bhaduri, D., & Saha, A. (2019). Impact of Organic and Inorganic Fertilizers on Soil Microbial
- Communities. *Applied Soil Ecology*, 138, 57-66.
- David, A. A., Thomas, T. and Reddy, I. S., 2022. Impact of Integrated Nutrient Management Practices on Soil Health Parameters and Yield Attributes of Soybean (*Glycine max* L.) var. JS-9560 in Inceptisol of Alluvial Soil, District Prayagraj, Uttar Pradesh. *International Journal of Plant & Soil Science*, *34*(20), pp.378-383.
- Devi, K. N., Singh, T. B., Athokpam, H. S., Singh, N. B. and Shamurailatpam, D. 2013. Influence of inorganic, biological and organic manures on nodulation and yield of soybean (*Glycine max* Merril L.) and soil properties. *Austra. J. Crop Sci*., 7(9):1407-1415.
- Gangwar, S., Patidar, D., Shrivastva, P., Bhagat, C. and Alawe, K., 2023. Effect of integrated nutrient management on growth, yield and chemical properties of Soybean (*Glycine max*). *Plant Archives*, *23*(1), pp.376-380.
- Khang, V. T., Patil, H. M. and Gudedhe, N. N., 2011. Effect of integrated nutrient management on onion yield and soil properties in soybean–onion cropping sequence. *Omon rice*, *18*, pp.112-120.
- Lal, R. (2015). Restoring Soil Quality to Mitigate Soil Degradation. *Sustainability*, 7(5), 5875-5895.
- Mao, W., Kang, S., Wan, Y., Sun, Y., Li, X. and Wang, Y., 2016. Yellow River sediment as a soil amendment for amelioration of saline land in the Yellow River Delta. *Land Degradation & Development*, *27*(6), pp.1595-1602.
- Olle, M., 2016. The effect of vermicompost based growth substrates on tomato growth. *Journal of Agricultural Science*, *1*(27), pp.38-41.
- Pande, A. D., Deshmukh, M. R., Bhale, V. M. and Umbarkar, A. S., 2023. Effect of various nitrogen management sources on growth and yield of Soybean in Vertisols. *The Pharma Innovation Journal*; 12(1): 1605-1607.
- Sheikh, M. A. and Dwivedi, P., 2017. Physico-chemical parameters of organic manure, soil and impact of organic manure and NPK fertilizer on seed germination of soybean and wheat. *International Journal of Engineering Technologies and Management Research*, *4*(12), pp.118-130.
- Smith, P., *et al*. (2017). The Role of Organic Amendments in Soil Fertility Management. *Journal of*
- *Agricultural Science*, 155(3), 408-420.
- Zerihun, A. and Haile, D., 2017. The effect of organic and inorganic fertilizers on the yield of two contrasting soybean varieties and residual nutrient effects on a subsequent finger millet crop. *Agronomy*, *7*(2), p.42.
- Zuo, W., Gu, C., Zhang, W., Xu, K., Wang, Y., Bai, Y., Shan, Y. and Dai, Q., 2019. Sewage sludge amendment improved soil properties and sweet sorghum yield and quality in a newly reclaimed mudflat land. *Science of the Total Environment*, *654*, pp.541-549.